

REMARKS:

- 1) On the acknowledgment copy of the IDS Form PTO-1449 of March 17, 2006 enclosed with the Office Action, the Examiner has not initialed but instead has crossed-out cited references AF and AG. Copies of references AF and AG were not inclosed with the IDS of March 17, 2006, because those references were cited in the International Search Report issued on January 18, 2005 in the corresponding PCT International Application. Thus, copies of references AF and AG should have been transmitted to the USPTO together with the International Search Report by the International Searching Authority in the proper international processing of this PCT application (see MPEP 1893.03(g)). Apparently, those references were not received or were lost in the USPTO. Thus, we are now enclosing additional copies of references AF and AG for the Examiner's consideration, along with another copy of sheet 1 of 2 of the IDS Form PTO-1449 of March 17, 2006 for the Examiner's acknowledgment.
- 2) The Examiner's attention is further directed to applicants' third Information Disclosure Statement filed on December 20, 2007. Please consider the cited reference and return an initialed, signed and dated acknowledgment copy of the IDS Form PTO-1449 of December 20, 2007.
- 3) A few minor clerical corrections have been made in the specification, without introducing any new matter. Entry thereof is respectfully requested.

4) The claims have been amended as follows.

Independent claim 1 has been amended to change "an impurity" to --nitrogen--, namely specifying the particular impurity being nitrogen. This is supported in the specification at page 9 line 11, page 11 line 26, page 2 line 24, etc. Independent claim 1 has further been amended to recite the additional feature wherein the diamond has a Knoop hardness on a (100) plane that is higher in a <110> direction than in a <100> direction. This feature of a different Knoop hardness in different crystallographic directions on the (100) plane is supported in the original disclosure at page 6 line 17 to page 7 line 12 and Fig. 2.

Independent claim 5 has been amended to recite that the amount of nickel is at least 0.01 ppm and not more than 10 ppm, as supported in original 6. Claim 5 has also been amended to recite the feature of the different Knoop hardness in different crystallographic directions similarly as claim 1 discussed above.

Independent claim 8 has been amended to recite that the amount of boron is at least 0.01 ppm and not more than 300 ppm as supported in original claim 9, and that the amount of nickel is at least 0.01 ppm and not more than 10 ppm as supported in original claim 10. Claim 8 has also been amended to recite the feature of the different Knoop hardness in different crystallographic directions similarly as claim 1 discussed above.

Claim 12 has been amended to be directed to a diamond jewelry article comprising a synthetic single crystal diamond, for example as supported in original claim 19. Claim 12 has further been amended to recite that the diamond has a crystal

containing nitrogen in an amount of not more than 3 ppm, for example as supported in the specification at page 9 line 11 and page 11 line 26. Claim 12 has further been amended to recite the feature of the different Knoop hardness in different crystallographic directions similarly as claim 1 discussed above.

Claims 6, 9, 10, 17 to 19 and 24 to 32 have been canceled.

Remaining dependent claims have been amended wherever necessary for proper conformance with the amended independent claims. Also, some claims have been editorially amended.

Claim 15 has been amended to recite that the crystal of the diamond further contains boron as a substitutional atom, for example as supported in the specification at page 10 lines 22 to 28.

Claim 16 has been amended to recite that the content amount of the boron is at least 0.01 ppm and not more than 300 ppm, for example as supported in original claim 9.

New dependent claims 37 to 41 have been added. These claims are supported in the original disclosure as shown in the following table, and do not introduce any new matter.

new claim	37	38	39	40	41	42
original support	Fig. 1; pg 18 ln 14	Fig. 1	pg 7, Table 1, samples 1 to 8	pg 7, Table 1, samples 3 to 7	pg 18 ln 14	pg 18 ln 18

In view of the above mentioned original support, the claim amendments and the new claims do not introduce any new matter. Entry and consideration thereof are respectfully requested.

- 5) Referring to section 6 on page 3 of the Office Action, the indicated allowance of claims 20 to 23 and 33 to 36 is appreciated. Claims 20 to 23 and 33 to 36 have been maintained without amendment and should thus still stand allowed.
- 6) Referring to section 2 on page 2 of the Office Action, the rejection of claims 1 to 3, 5, 6, 8 to 10, 12 to 15, 18, 24 to 28 and 31 as anticipated by US Patent 5,133,332 (Tanaka et al.) is respectfully traversed. This rejection will be discussed in connection with each of the affected independent claims.

Independent claim 24 and its dependent claims 25 to 32 have been canceled. Thus the rejection of claims 24 to 28 and 31 is moot.

Independent claim 1 as currently amended recites the diamond crystal contains nitrogen in an amount of at most 3 ppm, and the diamond has a Knoop hardness on a (100) plane that is higher in a <110> direction than in a <100> direction. This directionally differentiated hardness is a surprising unexpected feature of the synthetic diamond according to the present invention. As explained in the present specification at page 6 line 17 to page 7 line 12 and shown in Fig. 2 of the drawings, natural diamond (Ia) and typical synthetic diamond (Ib) having a nitrogen content of 60 to 240 ppm exhibit a greater hardness in the <100> direction than in the <110> direction on the (100) plane, but the opposite is true for the inventive synthetic diamond (IIa) having a nitrogen impurity of at most 3 ppm, namely this diamond is significantly harder in the <110> direction than in the <100> direction on the (100) plane (see Fig. 2). Particularly, in the

<110> direction, the Knoop indenter does not form any indentation on the diamond surface in a Knoop hardness test on the (100) plane, showing that the diamond is so extremely hard that the hardness cannot be measured or quantified in this direction.

Tanaka et al. disclose the general concept of a synthetic diamond single crystal containing boron from 0.1 to 500 ppm and optionally containing nitrogen from 1 to 500 ppm (col. 2 lines 33 to 37). Tanaka et al. also disclose that this diamond can be used for a cutting tool having a rake face oriented on the (100) plane with an edge direction of <110>, or with a rake face oriented on the (110) plane with an edge direction of <100>, or a rake face oriented on the (100) plane with an edge direction of <100> (see examples 6, 7 and 8). However, Tanaka et al. do not disclose or suggest the special inventive feature of the directionally different Knoop hardness, namely that the Knoop hardness on the (100) plane is higher in the <110> direction than in the <100> direction. There is also no discussion or suggestion about such directionally different hardness in the specified crystallographic directions. Thus, present independent claim 1 is not anticipated and would not have been obvious.

Currently amended **independent claim 5** recites the above discussed directionally different Knoop hardness like claim 1, and additionally recites that the diamond crystal also contains nickel in an amount of at least 0.01 ppm and not more than 10 ppm. This feature needs to be considered in combination with the feature of the diamond crystal containing nitrogen in an amount of at most 3 ppm. Thus, in claim 5, there must be the stated nickel content in combination with a low nitrogen content

of at most 3 ppm, along with the directionally different Knoop hardness. Tanaka et al. do not disclose and are not concerned with adding nickel as a purposeful addition to the diamond, but disclose that nickel may be present as an impurity. Namely, Table 9 in column 9 of Tanaka et al. shows a nickel content of 10 ppm. However, that compositional content of nickel is in combination with a high content of 10 ppm of nitrogen (see Table 9 and col. 9 lines 14 and 15 as well as sample 6 in Table 8). Thus, this disclosure of Table 9 does not fall within present claim 5 that requires a nitrogen content of at most 3 ppm in combination with the nickel content of at least 0.01 ppm and not more than 10 ppm. Therefore, the combined composition of present claim 5 is not disclosed. Also, as discussed above, Tanaka et al. do not disclose the feature of the directionally different Knoop hardness. Therefore, present independent claim 5 is not disclosed and would not have been suggested by Tanaka et al.

Currently amended **independent claim 8** recites the low nitrogen content, the directionally different Knoop hardness, and the specific nickel content similarly as claim 5 discussed above. Additionally, claim 8 recites that the diamond crystal further contains boron in an amount of at least 0.01 ppm and not more than 10 ppm. Thus, the same distinctions between claim 5 and Tanaka et al. as discussed above also pertain regarding present claim 8. Additionally, Tanaka et al. do not disclose the particular compositional combination of a nickel content of at least 0.01 ppm and not more than 10 ppm, a boron content of at least 0.01 ppm and not more and 300 ppm, and a low nitrogen content of not more than 3 ppm. The only disclosure of Tanaka

et al. regarding a combination of boron and nickel and nitrogen appears in Table 9, and as discussed above, in that combination the content of nitrogen (10 ppm) is much too high in comparison to the inventive limit of not more than 3 ppm. For these reasons, present claim 8 is not disclosed and would not have been suggested by Tanaka et al.

Currently amended **independent claim 12** is now directed to a diamond jewelry article comprising the synthetic single crystal diamond, according to prior claim 19. It is noted that claim 19 was not rejected as anticipated by Tanaka et al. Therefore, the anticipation rejection cannot be maintained against present claim 12 and its dependent claims. Still further, Tanaka et al. do not disclose a diamond jewelry article comprising a synthetic single crystal diamond in which the diamond crystal contains nitrogen in an amount of not more than 3 ppm and has a directionally different Knoop hardness as discussed above. There would have been no suggestions in this regard, and especially no suggestions why the differential hardness would be a desirable feature of a diamond for a diamond jewelry article.

The dependent claims are patentably distinguishable over Tanaka et al. already due to their dependence. The dependent claims also recite additional features that further distinguish the invention over the prior art. For example, claim 2 recites that the nitrogen amount is at most 0.1 ppm. To the contrary, Tanaka et al. disclose a nitrogen content of 1 to 500 ppm (col. 2 lines 33 to 37, col. 3 lines 30 to 34), and some samples containing 0.5 ppm of nitrogen (see examples 5 and 6), but all

of those teachings are significantly greater than the amount of nitrogen recited in present claim 2.

For the above reasons, the Examiner is respectfully requested to withdraw the rejection of claims 1 to 3, 5, 6, 8 to 10, 12 to 15, 18, 24 to 28 and 31 as anticipated by Tanaka et al.

- 7) Referring to section 4 on pages 2 and 3 of the Office Action, the rejection of claims 4, 7, 11, 16 and **19 (perhaps 29?)** as obvious over Tanaka et al. in view of US Patent 5,340,012 (Beeferman et al.) is respectfully traversed.

It appears that this rejection was intended to apply to claim **29** rather than **19**, because claim 29 related to a brazing material like claims 4, 7, 11 and 16, whereas claim 19 related to diamond jewelry to which Beeferman et al. is not relevant.

Beeferman et al. have been cited for disclosing a brazing material containing titanium. Beeferman et al. merely mention that the disclosed brazing material can be used for brazing diamonds (col. 6 line 24). Beeferman et al. would not have suggested anything about the particular composition and hardness of the diamond crystal itself as defined in the present independent claims and discussed above in comparison to Tanaka et al. Thus, even a combination of Tanaka et al. and Beeferman et al. would not have suggested the present independent claims. The dependent claims are patentably distinguishable over the prior art already due to their dependence.

For the above reasons, please withdraw the obviousness rejection applying Tanaka et al. in view of Beeferman et al.

- 8) Referring to section 5 on page 3 of the Office Action, the rejection of claims 7, 19, 30 and 32 as obvious over Tanaka et al. in view of US Patent Application Publication US 2003/0188550 (Oki et al.) is respectfully traversed. Claims 17, 19, 30 and 32 have been canceled, but the feature of incorporating the inventive single crystal diamond in a diamond jewelry article (according to original claim 19) has been recited in currently amended independent claim 12. While Oki et al. generally disclose the use of a diamond in a jewelry article, the particular composition of the diamond containing nickel and containing nitrogen in an amount of not more than 3 ppm, and the directionally different Knoop hardness of the diamond, as recited in present claim 12, are not disclosed and would not have been suggested by Oki et al. Because Oki et al. provide no disclosure in this regard, even a combined consideration of the two references would not have suggested the features of present claim 12 that have been discussed above in comparison to Tanaka et al. For these reasons, the Examiner is requested to withdraw the obviousness rejection applying Tanaka et al. in view of Oki et al.
- 9) The additional prior art made of record requires no particular comments because it has not been applied against the claims.
- 10) The new dependent claims recite additional features that further distinguish the invention over the prior art, for example as follows. Claims 37 to 40 depend from claim 1 and recite respective narrower limitations on the low nitrogen content,

being less than 3 ppm, or less than 1 ppm, or less than 0.5 ppm, or at least 0.04 ppm and less than 0.5 ppm. These very low contents of nitrogen further distinguish the invention from the nitrogen contents disclosed by Tanaka et al. Claims 41 and 42 depend from claim 5 and recite lower limits on the amount of nickel, being less than 10 ppm, or being less than or equal to 2 ppm. These low nickel contents further distinguish the invention from Tanaka et al. Entry and favorable consideration of the dependent claims are respectfully requested.

- 11) Favorable reconsideration and allowance of the application, including all present claims 1 to 5, 7, 8, 11 to 16, 20 to 23 and 33 to 42, are respectfully requested.

Respectfully submitted,
Hitoshi SUMIYA et al.
Applicant

WFF:he/4940
Enclosures:
Transmittal Cover Sheet
Copy of PTO-1449 of 03/17/06
sheet 1 of 2
copy of refs. AF and AG
postcard

By Walter F. Fasse
Walter F. Fasse
Patent Attorney
Reg. No.: 36132
Tel. 207-862-4671
Fax. 207-862-4681
P. O. Box 726
Hampden, ME 04444-0726

CERTIFICATE OF MAILING:

I hereby certify that this correspondence with all indicated enclosures is being deposited with the U. S. Postal Service with sufficient postage as first-class mail, in an envelope addressed to: COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450 on the date indicated below.

Walter F. Fasse 2/8/08
Name: Walter F. Fasse - Date: February 8, 2008